SYSTEM AND METHOD FOR A SLOTTED LINER SHOE EXTENSION

The present application claims the benefit of and priority to U.S. Provisional Patent Application Ser. No. 61/532,408 entitled "System and Method for a Slotted Liner Shoe Extension" and filed on Sep. 8, 2011, which is herein incorporated by reference in its entirety.

FIELD

The present application relates to an improvement of wells in subterranean formulations, particularly in geothermal wells. More particularly, the present invention is a system and method for a slotted liner shoe extension.

BACKGROUND

In geothermal wells, water wells, or some oil and has wells, the final drilled interval where production occurs is completed by hanging a liner such as a slotted or perforated casing string or a manufactured well screen from the last cemented casing string above. This last liner in those wells is not cemented in place. Instead, the open annulus between the last liner and the open wellbore is left open or sometimes is packed with gravel. This type of well completion technique stabilizes the production interval of the formation by leaving the maximum area open to the wellbore and reducing pressure drop as fluids enter the wellbore. Resultantly, the flow rate of fluids is increased to the well and the recovery of fluids during production is improved.

While this type of well completion technique reduces the pressure drop from flow into the well and improves production, it makes difficult and sometimes impossible some types of work on the well that are to be performed after the completion. For example, intervals behind the slotted or perforated liner or well screen are difficult to isolate for sealing a desired zone or stimulating zones deeper in the well. In an oil and gas well, a zone that has been produced may start to produce an increased flow of water or fluid injected to enhance oil or gas recovery such as steam, CO2, water or other fluid. The water or other fund may breakthrough in a particular zone. In geothermal wells, shallow zones that are productive may have cooler temperature fluids than expected, or cool injected water may enter the wellbore in the open interval.

Generally, wells that require stimulation may have a cemented casing at a shallower zone than needed to stimulate zones behind the slotted or perforated liner or well screen. This may prevent the build-up of pressures required to stimulate deeper zones because fracturing will occur in the shallow zones. Therefore, the maximum hydraulic pressure that can be applied in the stimulation treatment is limited to the fracture breakdown pressure at the depth of the last casing shoe. The limited hydraulic pressure hampers or disables stimulation of formation deeper in the open hole interval of the well. The potential for fluid production improvement, thus the economic value of the asset is compromised.

Sometimes, a packer is set in the slotted or perforated liner or a well screen, and cement is pumped into the liner above the packer. However, cement is denser than water, therefore cement flows down the annulus between the slotted liner and the wellbore, and enters permeable zones deeper in the well. The intrusion of cement into permeable zones needs to be avoided because this impairs production from these zones.

SUMMARY

A system and method for extending a slotted liner shoe is disclosed. According to one embodiment, a low density material is injected into a liner having a plurality of openings. The liner is suspended below a cemented casing in a wellbore of a well in a subterranean formation. The low density material extrudes through a lower portion of the liner into an annulus between the liner and the wellbore. A cement is circulated into the Liner above the low density material. The cement extrudes through an upper portion of the liner into the annulus between the liner and the wellbore. Water is displaced from the wellbore, and a solid cemented casing string is formed at a desired depth. If the plurality of openings is insufficient for the low density material to pass through to the annulus between the liner and the well bore, a perforating gun is used to enlarge openings.

The above and other preferred features, including various novel details of implementation and combination of elements, will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be understood that the particular methods and apparatuses are shown by way of illustration only and not as limitations. As will be understood by those skilled in the art, the principles and features explained herein may be employed in various and numerous embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included as part of the present specification, illustrate the presently preferred embodiment of the present invention and together with the general description given above and the detailed description of the preferred embodiment given below serve to explain and teach the principles of the present invention.

FIG. **1** illustrates a schematic of a slotted or perforated liner suspended within an open hole interval of a subterranean formulation, according to one embodiment;

FIG. **2** illustrates an exemplary fluid circulation pattern within a completed well with a slotted liner, according to one embodiment;

FIG. **3**A illustrates an exemplary isolation device set in a slotted liner, according to one embodiment;

FIG. **3**B illustrates an exemplary process for plugging an open hole using a low density material, according to one embodiment;

FIG. **3**C illustrates an exemplary process for cementing behind a liner according to one embodiment;

FIG. **3**D illustrates a schematic view of a drilled out well, according to one embodiment;

FIG. **4**A illustrates a schematic view of a low density plug without an isolation device, according to one embodiment;

FIG. **4**B illustrates an exemplary process for cementing behind a liner, according to one embodiment;

FIG. **4**C illustrates a schematic view of a drilled out well according to one embodiment;

FIG. **4**D illustrates a schematic view of a drilled out well after a thermally degradable material is degraded, according to one embodiment;

FIG. **5**A illustrates an exemplary circulation path of an injected fluid to surface, according to one embodiment;

FIG. **5**B illustrates an exemplary circulation path of an injected fluid to permeable zones, according to one embodiment; and

FIG. **5**C illustrates an exemplary circulation path of a particulate material injected, into a slotted liner, according to one embodiment.